

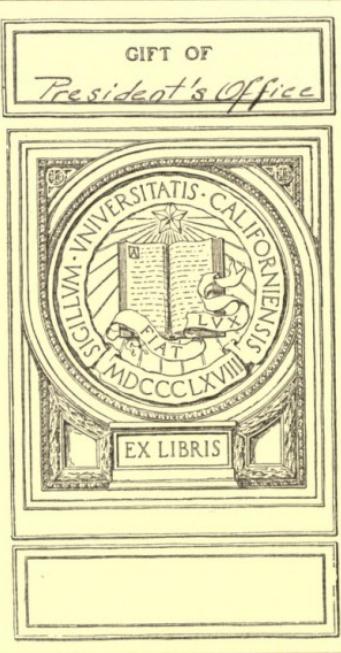
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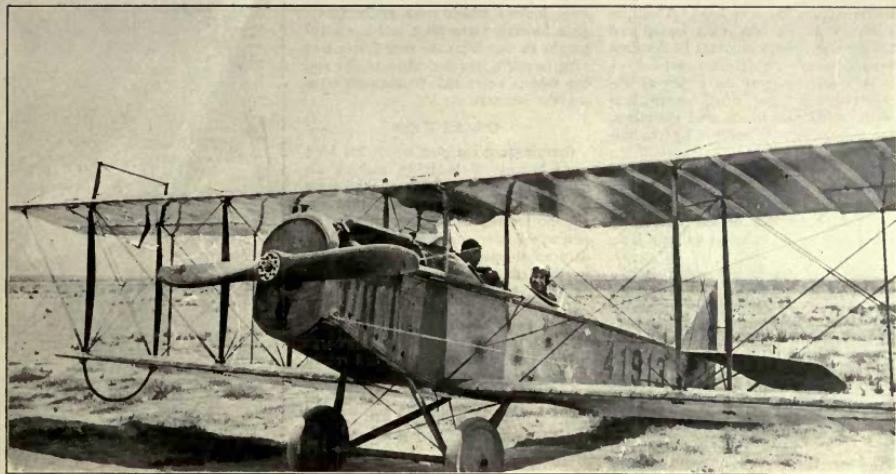
Photographing Clouds From An Airplane

By Ford A. Carpenter



UNIV. OF
CALIFORNIA

Ford A. Carpenter



UNITED STATES ARMY AIR SERVICE JN 4-H.S. No. 41913

July 17, 1919, 1:14 p. m. Camera faced SE

This plane was used in the making of the cloud photographs

Pilot: Lt. H. E. Queen, A. S. (A)

Passenger: Meteorologist Ford A. Carpenter

Photographing Clouds From An Airplane

By FORD A. CARPENTER*

Photographs by the Author

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B EING out of kodak films the writer dropped down from a ten thousand foot altitude, requisitioned a Ford from the transport officer at Rockwell field and crossed the causeway to Coronado. Sauntering into the cool and spacious lobby of the Hotel del Coronado he asked the clerk the way to the photograph department. The clerk recognized him as the former Weather Man at San Diego and greeted him heartily. "Won't you stay and have dinner with us?" "No," I replied, "I promised Frank Miller, Master of the Inn at Riverside, when I lunched there this afternoon, to dine with him on my return this evening." As I turned to buy the kodak films one of the flannel-clad bored-looking individuals who had heard the conversation, detained me with "Beg your pardon, but did I hear correctly? That you had lunched this afternoon at Riverside, and expect to dine there at six o'clock tonight?" "Sure," I replied, "I left the Mission Inn shortly after one

o'clock, motored to March field, took a JN-4 and having used up the last of my kodak films dropped down here to get some more." "No, I am not an aviator—just a plain, ordinary citizen out on a cloud photographing trip." The flannel-clad individual flipped the ash from his cigarette, turned to his interested companion and ejaculated: "Here's where my ten thousand dollar Rolls-Royce goes into the discard."

To my mind this incident illustrates the early superseding of the automobile by the airplane by people who want to accomplish a journey quickly and comfortably. All air-lanes are direct and smooth although in rare cases perhaps a trifle billowy. While the aviator should be competent to "stunt" in an emergency it should be no more the rule to practise acrobatics in the air than for the ordinary touring car to emulate a daredevil auto racer.

The three hundred mile cross-country flight of last July was made for the pur-

pose of photographing the higher variety of summer clouds and studying them at close range. Incidentally it was to further extend our studies into differing air levels, continuing this work begun in June. Most of my investigation into air levels of southern California has been accomplished by means of free balloons during a dozen or more flights during all hours of the day and night.

Recognizing the importance of aerial mapping and cloud studies from aloft, the Director of Air Service kindly placed a two-seater and an experienced pilot, Lieut. H. E. Queen at my disposal for the afternoon, with apologies to Ruskin he proved to be the "Queen of the Air." I decided to make the triangular course from Riverside to San Diego and along the coast from San Diego to Los Angeles and thence to the place of starting. The accompanying photographs with their notes were all made by the writer while in the air. Following out a custom inaugurated early in 1911,

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when air work was first begun by him, a five-minute log was kept. The importance of making one's notes and sketches at regular intervals **at the time** cannot be too highly recommended. I believe that most of the errors of observation are those which creep into notes made afterwards, and doubtless, are unintentionally colored by the imagination.

Geography of the Trip

The sketch map on this page will give the reader an idea of the interesting cross country flight taken on July 17th, 1919.

Probably there is no region in the world, at least in the United States, where weather conditions are so nearly ideal during practically the entire year as in southern California.

It was for that reason that this special journey was requested of the Director of Air Service. It will be noted that the route is triangular in shape and the course is from March Field nearly south to Rockwell Field, and from Rockwell Field skirting the coast northwesterly to DeMille Field, and from DeMille Field easterly to the point of departure.

Physiography of the Cross-Country Flight

The various physical characteristics of this portion of southern California are practically all covered in this triangular journey. The first part is over a region that receives only limited rain fall and has therefore, desert characteristics.

The second portion skirts the beautiful southern California coast with its barren but ruggedly picturesque and highly colored cliffs. Such is the proximity of a number of natural landing fields that an airplane may safely negotiate comparatively long stretches of coast with the sea directly beneath him.

The third phase of the journey, from DeMille Field on the western outskirts of Los Angeles to Riverside, is a district which is agriculturally probably the most valuable in the United States. Over this district the perfume of orange and lemon blossoms is carried upward thousands of feet.

Take Off at March Field

After being introduced to my pilot, Lieut. H. E. Queen, we walked over and selected a machine which had the necessary facilities for making notes and taking pictures. This machine proved to be a JN4-Hispano-Suiza motor with overhead gasoline supply and in all one of the best for this purpose of the hundred or so on March Field.

Ideal Arrangement of Rear Cockpit

The rear cockpit had a comfortable seat, with a narrow bench above which

were duplicate instruments. In the rear were lockers which were easily accessible holding spare films and the barographs so that from the very first it was easy to make frequent photographs and five minute notes and sketches throughout the journey.

Original Notes

Carrying out the plan which has long since become a habit in making air notes, memorandum notations were made at five-minute intervals, throughout the journey as to time, altitude, direction of course and under "remarks" data as to clouds, air conditions, etc., were noted.

Note Book Entries

Note book of airplane flight of July 17, 1919, shows the following summary:

March Field to San Diego and return via Los Angeles:

	Mins.	Miles
No. 1 Lv March Field	1:15 pm	
Ar Rockwell Fld	2:21 pm	76 90
No. 2 Lv Rockwell Fld	3:39 pm	108 130
Ar DeMille Field	5:27 pm	
No. 3 Lv Rockwell Fld	6:02 pm	
Ar March Field	6:57 pm	55 60
Totals		239 280

Flight No. 1

Date, July 17, 1919.

Airplane No. 41913.

Started from March Field 1:15 p. m.

Landed on Rockwell Field 2:31 p. m.

Duration of flight, 1 hour, 16 minutes

Distance, 90 miles.

Maximum altitude, 10,000 feet at 2:25 p. m.

General direction of travel, South.

Pilot, Second Lieut. H. E. Queen, A. S. (A.) at March Field.

Passenger: Dr. Ford A. Carpenter, Meteorologist.



SKETCH MAP OF TRIP

The route of flight is indicated by the broken lines. It will be noted that the journey covers mountains, plains and coast. For variety of scenery and security of air-lines it is doubtless unsurpassed in the United States.

Record of Voyage

Time in use in summer time, 1 hour faster than Standard Normal 120th Meridian. Altitudes are above sea level.

Time. Altitude Ft. Dir.

1:15 p.m.	1,500	S. S. E.	At second minute after start altitude 2,800.
1:20 p.m.	3,000	S. S. E.	Air somewhat humpy.
1:25 p.m.	3,600	S. S. E.	Ship alternately lifting and settling, like going over a swell in a canoe.
1:30 p.m.	4,500	S. S. E.	
1:35 p.m.	5,200	S.	Air steadier. Stronger convectional action noted in neighboring clouds. Cumulo-nimbus to E.
1:40 p.m.	5,900	S.	Clouds heavier; heading into a thunderstorm.
1:45 p.m.	6,150	S.	Storm to the east, gathering strength.
1:50 p.m.	6,550	S.	Cumulo-nimbus heavy in east.
1:55 p.m.	6,870	S.	Clouds now reach to zenith, course veered to E. Ship swaying slightly.
2:00 p.m.	7,100	S.	Above cumulus clouds; on level with cirro-stratus. Sprinkles of rain.
2:05 p.m.	7,800	S.	Course apparently bringing ship into a rainstorm.
2:10 p.m.	7,950	S.	Passing over cumulo-nimbus masses, having characteristics of cirro-cumulus.
2:15 p.m.	8,200	S.	First view of San Diego bay; ocean is seen to be cloud-covered.
2:20 p.m.	8,910	S.	Heavy clouds observed over sea.
2:25 p.m.	10,000	S.	Clouds now seen to be skirting coast-line.
2:30 p.m.	700	...	

Notes

2:31 p.m. 0 ... Landed Rockwell Field. Reported to commanding officer; called up Los Angeles Weather Bureau office as to nature and extent of cloud formation. Found it to be coastwise and occurring on elevations above the 6,000 ft. range of mountains. Motor Transportation officer furnished car and driver for Meteorologist Carpenter to secure photographic supplies from Coronado.

Flight No. 2

Date, July 17, 1919.

Airplane No. 41913.

Started from Rockwell Field 3:39 p. m.

Landed De Mille Field, Los Angeles, 5:27 p. m.

Duration of flight, 1 hour, 48 minutes.

Distance, 130 miles.

Maximum altitude, 6650 feet at 5:11 p. m.

General direction of travel, Northwest.

Personnel, equipment and load, same as Flight No. 1.

Time. Altitude Ft. Dir.

Notes

3:39 p.m.	0 ...	Velo clouds predominant, especially over city of San Diego.
3:45 p.m.	2,250 N. W.	Above velo clouds.
3:50 p.m.	3,100 N.	Over Pacific Beach.
3:55 p.m.	4,100 N.	Over La Jolla.
4:00 p.m.	4,200 N.	Over open sea.
4:05 p.m.	4,050 N. W.	Over sea off Encinitas.
4:10 p.m.	4,050 N. W.	Off Oceanside.
4:15 p.m.	4,050 N. W.	Passed Oceanside.
4:20 p.m.	4,050 N. W.	Last of fog; Ci-Cu clouds in north.
4:25 p.m.	4,075 N. W.	Santa Ana Mountains to east.
4:30 p.m.	3,975 N. W.	Off San Onofre.
4:35 p.m.	4,050 N. W.	Ship somewhat unsteady.
4:40 p.m.	4,300 N. W.	Nearing Laguna Beach.
4:45 p.m.	4,900 N. W.	Nearing Newport.
4:50 p.m.	5,050 N. W.	Off Seal Beach.
4:55 p.m.	5,400 N. W.	Ship headed landward.
5:00 p.m.	6,100 N. W.	Nearing Long Beach. Fog and low cloud over Venice.
5:05 p.m.	6,150 N. W.	Over Long Beach; Signal Hill. Bunch of clouds over Santa Monica bay.
5:10 p.m.	6,500 N. W.	Nigger Slough off port bow. Cumulo-nim. clouds on crest of north mountains.
5:15 p.m.	5,300 N. W.	Nearing Los Angeles. Haze limit at 4,000 feet elevation.
5:20 p.m.	4,600 N.	Over Exposition Park.
5:27 p.m.	200 ...	Landed De Mille Field. Secured oil and gasoline.

Flight No. 3

Date July 17, 1919.

Airplane No. 41913.

Started from De Mille Field 6:02 p. m.

Landed March Field 6:57 p. m.

Duration of flight, 55 minutes.

Distance, 60 miles.

Maximum altitude, 4,030 feet, at 6:55 p. m.

General direction of travel, East.

Personnel, equipment and load, same as Flight No. 1.

Time. Altitude Ft. Dir.

Notes

6:02 p.m.	200	Left De Mille Field.
6:05 p.m.	1,300 S. E.	Over Los Angeles, business district off port bow.
6:10 p.m.	2,200 E.	Over Los Angeles, passed over Los Angeles river bed.
6:15 p.m.	3,000 N. E.	Over Newark.
6:20 p.m.	3,500 N. E.	Whittier to starboard. Over orange groves.
6:25 p.m.	3,200 N. E.	Over San Gabriel debris cone. Over orange groves.
6:30 p.m.	3,100 N. E.	Over San Jose hill; bump near hill; over orange groves.
6:35 p.m.	3,100 E.	Cucamonga debris cone to north; over orange groves.
6:40 p.m.	3,000 E.	Haze lowering to 1,000 feet. Over orange groves.
6:45 p.m.	3,000 E.	Going through deep gorge, crests less than 800 feet below ship.
6:50 p.m.	3,900 E.	Over Riverside. Over orange groves.
6:55 p.m.	4,030 E.	Entering Allesandro. Engine off.
6:57 p.m.	1,500 ...	Landed.



DIRECTLY OVER CIRRO CUMULUS CLOUDS

Elev. 7800 ft. 2:05 p. m. July 17, 1919

Camera faced downwards

The first variety of cirro-cumulus clouds was encountered at 7800 feet; within 15 minutes the ship passed over better examples, a trifile over a thousand feet higher. The more elevated clouds were of a detached nature and had a lower temperature. Owing to the background of earth, these clouds showed up to better advantage than against the sky.

CLOUD NOTES Cumulo-Nimbus

These formations were observed over the surrounding mountains from about 9 a. m., July 17. The best example of Cu-Nim. was observed to the S. W. nearly in the path of the first flight. At 1:40 p. m., elevation 5,900 feet, the ship headed into a well marked example of Cu-Nim. Five minutes later and 250

feet higher, the ship passed over detached cumulus clouds having the characteristics of Ci-Cu. At 1:50 p. m., at

movement and the resulting weather conditions. To my mind cloud study should comprise as much as one-half of

most valuable local indication of coming changes in weather conditions. The clouds, by their character, indicate the observer's position and proximity with reference to the low pressure area.

Clouds and Storm Centers

A moment's reflection shows that the true direction, as well as the force or the drift of the earth's atmosphere, as depicted by the clouds, is conclusive as a weather indication only in that it determines the relative position and intensity of the storm center.

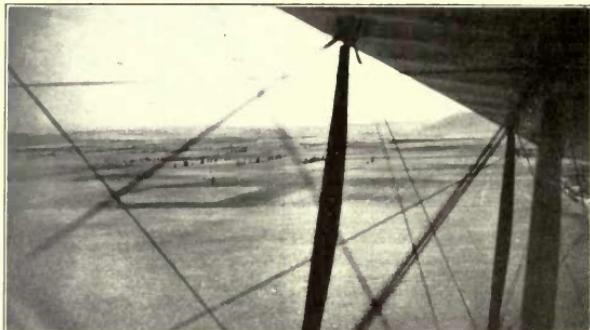
"Weather" Is Under 20,000 Feet

The layer of cloud covering the earth is relatively very thin. If, for example, we could examine the earth from the moon, we would doubtless see a veil of cloud covering little more than half the surface. At that distance the clouds would have no texture, the earth would appear swathed in an irregular sheet of formless vapor, through which, from time to time, the land and water areas could be seen.

The cloud-cover of the earth is most attenuated; it may be compared to a film, for it is supposed to be less than one eight-hundredth of the earth's diameter in vertical thickness.

Weather Belt Is Very Thin

The thinness of the earth's atmosphere may be more clearly comprehended if we realize that the relative thickness of the cloud-layer on an eight-inch terrestrial globe would be about one-hundredth of an inch. Yet it is in this thin belt that clouds form, so that it is seen our



LEAVING MARCH FIELD, 3000 FT. ABOVE SEA LEVEL

July 17, 1919, 1:20 p. m. Camera faced NE

At about 1400 feet above the ground Hemet Valley presented the aspect of a huge grainfield, recently harvested. Above this valley the air was somewhat bumpy.

6,550 feet elevation, the temperature dropped at least 10 degrees and the towering mass of the Cu-Nim. appeared to reach the zenith. Five minutes later the first sprinkle of rain occurred. At 2:15 p. m. the ship passed away from the influence of the Cu-Nim.

Cirro-Cu.

The ship passed over some good examples of Ci-Cu. at 8,910 feet elevation at 2:20 p. m. The sky was covered with cumulus clouds especially thick near the shore; the clouds appeared to be less dense out at sea 10 or 12 miles.

Velo

These clouds were first encountered in the vicinity of San Diego bay. The velo cloud is distinctly associated with San Diego; no other locality can lay claim to it in such perfection as it exists within that district. This cloud persisted until about 4:35 p. m. at 4,050 elevation, or off San Juan Capistrano.

Cloud Study From the Ground

In another place and in another form* I have recounted some of the aspects of cloud classification, cloud composition, and cloud formation. As bearing directly on the matter in hand this monograph of California clouds will be freely drawn upon.

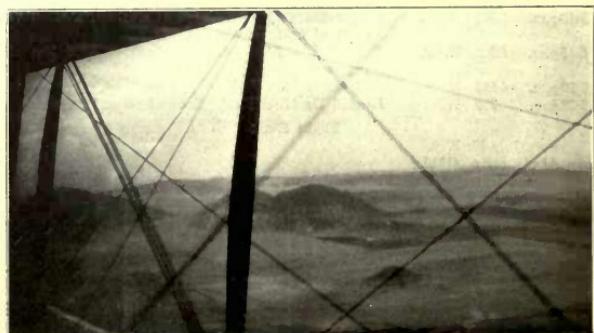
Observations of Clouds

To the aviator, clouds are a sure guide to the weather in the different air levels, and too much emphasis cannot be laid upon the importance of a thorough knowledge of cloud structure, cloud

a course in meteorology. In my earlier talks (1915) on weather as affecting flying, the students on North Island (now Rockwell Field), were given several illustrated lectures on clouds and their meaning.

Clouds Are Best Weather Indicators

Clouds have long been the most important feature of individual study. Previous to the last few hundred years



DOUBLE BUTTE, PERRIS VALLEY (ELEV. 3600 FT.)

1:25 p. m. July 17, 1919 Camera faced N

March Field is just above the Butte and a little to the left. The San Bernardino mountain range is in the distant background. At this portion of the voyage the ship alternately lifted and settled something like a canoe in negotiating a long swell.

weather forecasting with the least pretense to a scientific basis was founded on no other observations than the character and movement of clouds. And now, at the present stage of the knowledge of meteorology, they still give the

weather is produced within limited confines.

Four Classes of Clouds

Cirrus:

Cirro-stratus.

Cirro-cumulus.

* Clouds of California by Ford A. Carpenter, Ft. Leavenworth Army Press, 1914.



CRESTS OF CIRRO-CUMULUS CLOUDS
Elev. 6550 ft. 1:50 p. m. July 17, 1919

Camera faced SE

Below, there appeared masses of cumulo-nimbus clouds which reached their maximum density in the east; above them were higher cirro-cumulus clouds through which fringe the ship passed.

In a few minutes the ship passed from one clump of cirro-cumulus cloud to another, much as a hawk might fly from one haystack to another; but with the difference in that the cloud formation was frequently traversed.

Cumulus:

Alto-cumulus.

Fracto-cumulus.

Stratus:

Alto-stratus.

Strato-cumulus.

Fracto-stratus.

Nimbus:

Cumulo-nimbus.

Fracto-nimbus.

To the above general classification there may be added a local cloud, el velo, sometimes known as "high fog." El velo is the common cloud of early morning and late evening. Of this, however, more will be said later.

Clouds in the Making

It is not often given one to select a day when most varieties of clouds are in evidence. First I thought that there would be insufficient clouds on the day selected, and later, from the threatening aspect of the cumulo-nimbus clouds over the mountains and in the high levels, it seemed as if there might be too many varieties of the sterner sort. Fortune again favored me and we had on this journey practically all of the varieties,—the low kinds were not too low, and the higher kinds were not too high. Perhaps it might be as well to examine, briefly, into the composition of clouds, and, later, in the mechanics of cloud formation.

Composition of Clouds

Clouds occur whenever the temperature is lower than the saturation-point of the air, so that no matter how light or fleecy they may be, or how dense may

be the fog, the cloud-mass shows by its presence that precipitation is taking place. Their height defines their relative density.

Here are the general classifications: Cirrus, cumulus, stratus and nimbus.



CUMULO-NIMBUS ("THUNDER HEADS") CLOUDS

Elev. 7100 ft. 2:00 p. m. July 17, 1919

Camera faced SE

This close view of thunder-clouds was obtained during intervals of rain. The upper portion of the clouds were rounded and billowy. This formation appeared to boil and seethe, the temperature became lower by 10 degrees, and nearby cumulo-nimbus clouds rose like mountains of cloud or fog.

Cirrus, the Highest Cloud

This is of delicate fiber, feathery in structure and pure white in color. It is the most elevated of all clouds, having an average altitude of five miles, and sometimes extending into the lower limit of the so-called isothermal region of the atmosphere. This cloud is doubtless composed of speiculae of ice. A popular name for this cloud is "mare's tails," and it is the wind cloud of the sailors.

Cumulus, the Day Cloud

The typical summer clouds that thrust their heads up into the air—they are the

great convectional clouds. Generally speaking they are thick and dense and their tops are smaller than their bases. As they are caused by ascending currents, their life is dependent upon the duration of the vertical current, so that when the air ceases to rise, the cloud disappears. During the ascent of the sounding balloons at Avalon, Catalina Island, in the summer of 1913, especial care had to be taken not to let loose the balloons during the proximity of cumulo-nimbus clouds, as they were the danger signals of strong upward air currents.

Stratus, the Low Cloud

A gray, undefined cloud sheet, in fact, any horizontal mass of uniform thickness, independent of height, characterizes this cloud. When it is of low altitude it sometimes becomes the velo cloud. The stratus cloud is of considerable value as an insulator of the sun's rays, and, on the other hand, almost entirely checks the loss of heat by radiation from the earth at night. May and June would be among the hot months in littoral California were it not for the then prevailing cloud. In winter, citrus growers know that there will be no frost if stratus clouds are present, for they serve



CIRRO-STRATUS CLOUDS
Elev. 7950 ft. 2:10 p. m. July 17, 1919

Camera faced E

Excellent examples of cirro-stratus clouds were observed and this photograph shows a distant and a close-up view of these clouds. Although the texture of these clouds appeared to be identical, a solar halo was observed, in sections, among the distant clouds but was not noticed in the nearby examples.



LAKE HODGES ON THE SAN DIEGUITO
RIVER (ELEV. 7050 FT.)
2:12 p. m., July 17, 1919
Camera faced downwards

This reservoir was made by the damming up of a portion of the San Dieguito river. The white outlines are the beach lines of high water. The dam at the lower end of the lake is plainly seen as is also the road leading into Encinitas which is the nearby town.

as a blanket and thus hold the earth's heat.

Nimbus, the Rain Cloud

The rain cloud; technically it is any cloud mass from which precipitation is falling. It always forms under a higher variety of cloud.

Modification of Cloud Forms

These four are the general classification of clouds all over the world. A

modification of these varieties gives the following modifications:

Cirro-Stratus

Cirro-Stratus, which is easily distinguished by the fact that in it are formed the halos. The diffraction of light by this cloud produces rings around the sun and moon, technically known as the

solar and lunar halos of 22° and 45° radii.

Cirro-Cumulus

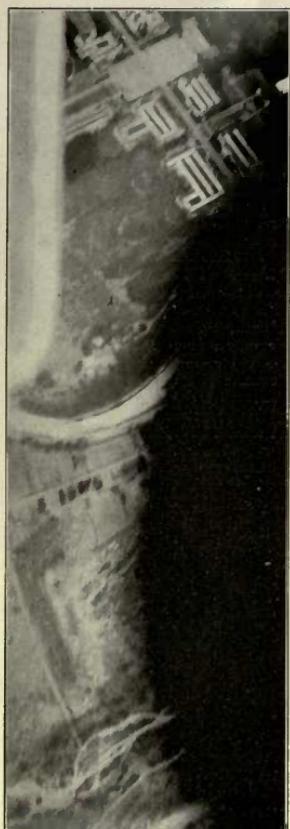
Cirro-cumulus forms in semi-transparent balls; it is the mackerel sky cloud that forms suddenly and marks the transitory stage between a higher and a lower variety, or vice versa. This cloud was very much in evidence within a



CAMP KEARNY ON LINDA VISTA MESA

Elevation 9500 ft. 2:21 p. m. Camera faced NW

This military encampment may be seen just beyond the State highway which bisects the photograph. San Clemente creek and wash are below the highway. Poway is north of the camp. The ocean may be observed along the upper margin of the picture.



SAN DIEGO EXPOSITION BUILDINGS
Elev. 8000 ft. 2:22 p. m. July 17, 1919
Camera faced downwards

Crossing the San Diego River the path of the ship led over the San Diego Park in which are located the buildings of the San Diego Exposition of 1915, now used by the United States Marines.

quarter of an hour after leaving March Field. It was like sailing from one aerial haystack to another, so well-defined were these round cloudy masses. When this cloud is accompanied by threatening phenomena it is the surest rain indication that we have in Southern California.

Alto-Cumulus

Alto-cumulus is composed of small masses of cumulus cloud in parallel rows.

Fracto-Cumulus

Fracto-cumulus.—This term is applied

to a cumulus cloud when its edges are torn or shredded by the wind.

Alto-Stratus

Alto-stratus is a high stratus cloud, nearly always thickening into the ordinary low type and becomes a somewhat threatening cloud. This formation causes the solar and lunar coronae.

Strato-Cumulus

Long featherly rolls which are shallow in winter, and if present in quantities are a threatening indication. During the spring and summer, they generally disappear without causing precipitation.

Fracto-Stratus

This is the lowest cloud form, and is therefore only a slight remove from fog tattered by the surface wind.

Cumulo-Nimbus

Cumulo-nimbus is the thunderhead, and the most impressive of all cloud forms. When whisps of thundercloud are seen above the towering masses they are called "false cirrus."

Fracto-Nimbus

Fracto-nimbus.—Near the level of the sea this is the "scud" of the sailors. Among the higher levels, it sometimes occurs as a trail of cloud dark with moisture stringing after the larger cloud, sometimes dissipating before the lower edges of the veil reach the earth.

Altering Composition of a Cloud Mass

The study of the composition of the clouds is quite important if we wish to interpret their meteorological significance correctly. The altering composition of a cloud-mass, whether a higher cloud is changing to a lower variety, or whether a cloud near the earth is dissipating—both processes have a direct bearing on local weather conditions.

What Makes the Clouds?

Before leaving this subject let us examine into the causes which underlie the structure of cloud.

Formation of Clouds

Minute nuclei make possible cloud formation. Laboratory experiments demonstrate that condensation in air can not occur unless there is some object on which the condensation can take place, whether it be a material surface, a dust or water particle.

Nuclei are necessary for the formation of a water drop. It is a most important fact that a water-drop can not be formed in the free air unless there first be a nucleus on which the moisture can be deposited. The nuclei may be dust particles or ions. Experiments show that the condensation occurs at a much lower temperature in dust-free air, so that dust particles are by far the more important source of nuclei. As for dust, it must not be supposed that condensation is delayed on account of the absence of dust nuclei, for we have no instance in nature where the air is so pure near the earth that vapor could not form. A beam of light, whether it be from the sun or an artificial source, shows innumerable dust motes in its projection through the air. In fact, we know that light itself is made visible because of the presence of these dust motes. The dustier the air, the greater the diffusion of light. As ionized air permits condensation though dust may be absent, it is probable that the condensation at the higher levels of the atmosphere may be thus caused.



OVER SAN DIEGO BAY (ELEV. 3000 FT.)

2:16 p. m. July 17, 1919 Camera faced SE

This photograph was made while the ship was passing over Coronado ferry. The Coronado terminal of the ferry may be seen on the right margin of the picture as also the boathouse of the San Diego Yacht Club. The ferry may be noticed just approaching the San Diego slip. To the right of the ferry slip are the American Hawaiian Company's docks and across from these are the old wharves of the Pacific Coast Steamship Company and midway to the shore are the clubhouses of the San Diego Rowing Club. The smoke is from the sawmills in the lower part of town.



LANDING THROUGH VELO CLOUDS—ROCKWELL FIELD

Elev. 1500 ft. 2:28 p. m. July 17, 1919 Camera faced SE.

As the ship approached the coastline, the velo clouds became thicker. These clouds appeared to fringe the coastline with a seaward limit of not exceeding 6 miles and a shore limit of about twice that distance.

The Size of a Drop of Water

The size of water drops has been found to average one-thousandth of an inch in diameter. Experiments prove that such a drop falls at the rate of two inches per second. This unusually slow rate led the earlier investigators to believe that droplets were hollow spheres, hence the vesicular theory of rain formation. It has since been discovered that particles of steam or fog are solid globes. Ascending air currents readily suspend such minute and slowly falling particles, often forcing them upward a great distance. In the case of thunderstorms, the convectional force is terrific; witness the size of hailstones which owe their size to their being forced upward many times to a great height for their numerous coatings of ice.

What Causes Condensation?

Condensation necessary for the formation of clouds may be caused by either convection or contact. Convective clouds are produced not because the air mass rises into a colder region, but because the mass itself has been dynamically cooled. Cumulus clouds, rain clouds, and rain itself, are due to dynamic cooling.

How "Lows" Cause Cloudiness

Another form of convection results from the great whirling eddies of the atmosphere, which are the "lows" of the weather map. Local reduction in atmospheric pressure will also cause ascending currents.

Down Currents Give Fair Weather, Up Currents Rain

Whether or not the currents are ascending or descending may be readily observed by the tips or tufts of the cloud formation. If these feather edges point downward, we know that the winds are descending and therefore becoming

warm and dry; if ascending they are becoming cool and moisture-laden. Local ascending currents may be caused by forest or other fires. Spectators of the great San Francisco fire described

cords from the instruments which soared twenty miles and over, showed that the steady decrease in moisture is uniform, becoming practically nil at the upper limits.

It was also found that the velo cloud of this coast extends upwards on an average of one-quarter of a mile; that the trade-wind is about two and one-half miles thick; and that the particles composing the highest cirrus clouds are widely separated and are continually forming and re-forming, generally at an elevation exceeding five miles.

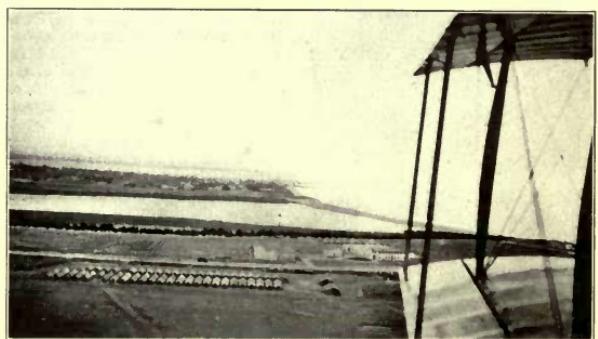
In Nature's Laboratory

Nearly all cloud observations have been made either on the ground or seated in a swivel-chair before mathematical formula. No subject is of more absorbing interest to either class of investigator, but for genuine adventure in cloudland give me a balloon or an airplane and a ray-filtered camera.

Here are some of the clouds which we studied and photographed:

Cumulo-Nimbus, the Lions of the Sky

The first clouds encountered on this journey were the cumulo-nimbus. In the air it is sometimes difficult to deter-



NORTH ISLAND AT 1500 FEET

3:40 p. m. July 17, 1919 Camera faced E
The buildings in the foreground are those of the Army Air Service comprising Rockwell Field, located on North Island. The residence of the Commanding Officer may be seen just under the tip of wing.

Across the narrow strip of water (Spanish Bight) is Coronado and the Hotel del Coronado may be seen in the distance with Coronado Tent City just beyond on both the ocean front and the Bay of San Diego.

a towering cumulus cloud which overhung the burning city. When a fierce forest fire occurs on a calm day a small cumulus cloud capping the smoke column is not an unusual sight.

Measurements Up to 108,000 Feet Altitude

In the summer of 1913 cloud investigations were carried on by the aid of free balloons. For example, the balloon soundings at Avalon in July and August of that year, revealed some of the innermost secrets of the clouds. The re-

mine whether a towering thunderhead is a cloud or a mist-covered mountain.

At first sight it was somewhat terrifying, for the plane was apparently headed for destruction. But like Bunyan's lions their appearance only was terrifying.

Anticipation Far Exceeded Realization

It was observed especially whether the eddying wind movement in the vicinity of these clouds affected the behavior of the ship. It did not. Perhaps it was owing to the skill of the navi-

gator, much as a good sailor will so take advantage of wind and currents as to keep his vessel from either pitching or rolling.



LEAVING ROCKWELL FIELD (ELEV. 2250 FEET)

3:45 p. m., July 17, 1919 Camera faced E

This photograph shows Coronado from Rockwell Field. To the north may be seen San Diego bay, with the San Diego-Coronado Ferry slip. In the immediate foreground is Spanish Bight which is now bridged by a causeway. The racetrack and golf links of the Country Club skirt the Bight. Glorieta Bay is all but hidden by a cloud as is also Hotel del Coronado. Beyond the limits of Coronado may be seen the upper reaches of San Diego Bay. The ship's course at the time this photograph was made was due south.

Cirro-Cumulus the Sheep of the Sky

If the thunderheads are the lions of the sky, then the cirro-cumulus are the peaceful sheep. In regard to the cirro-cumulus my notes say:

"No sight is more exquisite than the cirro-cumulus cloud-flecked air as seen from above."

As these cirro-cumulus clouds became more closely packed it was like sailing from one hill-top of mist to another. We passed through several; some were

Recognizing An Old Friend

The minutes sped by so rapidly that before I realized it the long low-lying cloud which had been observed skirting the coast resolved itself into our old familiar friend the Velo cloud.

The Velo Cloud

This cloud is peculiarly a product of the Pacific coast; of all the delightful memories of San Diego the one that sticks closest is that of this early morn-



SAN DIEGO BAY FROM ABOVE POINT LOMA
Elev. 3000 ft. 3:50 p. m., July 17, 1919 Camera faced SE

The ship's course paralleled Point Loma. In the foreground are the roads of the Theosophical Headquarters, in the middle foreground is Dutch Flats and cutting the left portion of the picture (near right wing of airplane) is the Santa Fe tracks entering Old Town. The extreme right is the Coronado shore. The greater portion of the city of San Diego is shrouded in cloud and fog.

ing and late evening cloud. The writer described this cloud in a small volume on local climatology* from which the following has been condensed:

"El Velo De La Luz"

The challenge, "We all know the winters are warm in San Diego, therefore the summers must be hot," constitutes the most common misunderstanding of San Diego's cool summers. The fact that there is less than one hour per year above 90 degrees is not easy to explain, until we remember the old Mexican phrase, *El velo de la luz*, "The veil that hides the light." This is a folklore expression, originating not only before the Gringo came, but, doubtless, long before the coming of the old Spanish conquistadors. The better-known English term, "high fog," has, in common with most words of our language, a double meaning, and it is misleading to a non-resident.



POINT LOMA WITH BALLAST POINT IN FOREGROUND (ELEV. 2250 FT.)
3:47 p. m., July 17, 1919 Camera faced SW

The Lighthouse reservation on Ballast Point may be seen in the foreground, and partially enshrouded in fog and jutting out into it is the headland of Point Loma.

It is not fog in the generally accepted meaning, for this "light veil" is neither cold nor excessively moisture-laden. Neither is it high, for its altitude is less than a thousand feet.

* Climate and Weather of San Diego, by Ford A. Carpenter, Mount Pleasant Press, 1913.



MOUNT SOLEDAD (LA JOLLA) ELEV. 4100 FT.

3:55 p. m., July 17, 1919 Camera faced W'

The sea wall is just beyond the white edge of cliffs partially covered with velo cloud. The roads winding up Mount Soledad (1000 feet high) may be observed in the middle foreground.

The Velo Is Not a Winter Cloud

To one who has spent a few weeks of spring, summer, or fall in Southern California, the picturesque description of the musical Spanish *el velo* is quickly recognized as both expressive and truthful.

A noted English traveler gave his views on the "velo" cloud in a communication to the San Diego "Union." He said:

I am glad that the old Spanish word "velo" is brought to light. The velo cloud is so expressive of the lovely diaphanous cloud that, of a midsummer's morning shades San Diego's brilliant sun until such time as the "veil" is swept aside by the ocean breeze, whose cooling breath renders it no longer necessary for a perfect day by the "Harbor of the Sun." I have always felt sure that those fine old Spaniards never damned so good a thing by such an abusive and misleading term as "high fog." As bearing on the new, yet very old, word "velo," I remember that one day in April, when off the coast of Lower California, an intelligent Spanish gentleman referred to this very cloud condition as the "velo qui cubre la luz del sol." I also heard it spoken of as "*el velo de la mañana*," showing that, while many phrases are used, the leading idea is the poetic one of a "veil."

The Velo Is a Characteristic Cloud

While the velo cloud is common to the Pacific coast generally, and has been observed as far north as the Straits of Fuca, this cloud reached its perfection over the littoral region of Southern California.

The velo cloud is the chief characteristic of the summer climate of the San

Diego Bay region. And summer should be understood as covering all the year excepting November, December, January and February. These four months could easily be reckoned as spring-time.

Screening Effect

The screening of this region from the sun's rays is so thoroughly accomplished that, during a normal summer's day, the sun breaks through the velo cloud about 10 o'clock, the sky clearing shortly af-



ALLIGATOR HEAD AND LA JOLLA CAVES (ELEV. 4100 FT.)

3:55 p. m., July 17, 1919 Camera faced E'

Alligator head is to the right, the Caves to the left between them is the Bathing Cove. On the beach of the Cove may be seen black pin points which are bathers. The view was made through attenuated velo clouds. Seaweed partially covered the ocean which was unusually rough; the heavy swell may be noticed on the right, near the shadow of the ship's stay.

terwards and remaining free from clouds until about sunset.

That the velo cloud is effective as a sun-shield, it needs only to be stated that the average of all the July maximum weather temperatures since weath-

er observations began shows a mean of about 78 degrees.

Formation of the Velo

The cause of the formation of the velo cloud and, consequently, the cool summers of San Diego, is, strange to say, found in the hot weather in the interior of California and Arizona. It is a unique example of the aptness of the proverb, "It's an ill wind that blows nobody good."

The hot weather in the interior produces an aerial eddy (the "low" of the weather map), and the difference in atmospheric pressure between the interior and the ocean results in giving San Diego cool, uniform days and nights, free from extremes, or what is really the summer temperature of the Pacific ocean. The velo cloud should therefore be incorporated in our local vocabulary, and it should replace the monomer "high fog."

Lakes as Seen From the Air

One of the most exquisite views from a plane in my opinion, is a lake or reservoir and Lake Hodges on the San Dieguito river, which we passed over at nearly eight thousand feet elevation, was no exception to the rule.

Owing to the time of the year the water in this artificial lake was somewhat depleted leaving a shimmering, white border which formed the edge of the lake.

As Lake Hodges was not on the map

it was quite disconcerting to locate our whereabouts but with the compass I decided that the lake had been created since the map was printed.

This is another example of the usefulness of the airplane in not only



NEAR OCEANSIDE (ELEV. 4050 FEET)
4:10 p. m., July 17, 1919 Camera faced E

The ship was skirting the coast and skimming along over thin velo clouds. The city of Oceanside may be observed in about the center of the middle foreground. Note the long wharf which extends out into the surf-fringed ocean. The hotel and railroad station may be observed near the intersection of the road from the wharf and the state highway.

showing very clearly the necessity for accurate maps, but filling that want with the aid of a camera. I believe that if there is one thing that has caused more damage to aircraft and death to aviators it has been defective maps.

Aerial Mapmaking a Profession

Aerial mapping by photography is one of the good things that has come from the war. It is a profession all in itself and the work that has been accomplished in these lines marks a wonderful advance both in photography and in the manufacture of charts.

The mapping of the San Diego Bay region by the 51st Aero Squadron early this year marks a notable achievement. This particular map was produced by making a mosaic of not less than forty five hundred photographs.

These infinite number of photographs were reduced and copied so as to present an appearance to the beholder as if the ground were viewed at an elevation of 25,000 feet.

A Military Encampment

Less than ten minutes after we passed over Lake Hodges we reached Camp Kearny on the Linda Vista Mesa.

This marvelous mesa extending just beyond the San Diego river over a district ideal for camp and manoeuvres has lain practically idle for all of these years. Thanks to the generosity of the citizens of San Diego this magnificent district, perfect in all details of soil, drainage and climatic conditions, formed probably one of the finest locations for a military camp.

A very comprehensive view of Camp Kearny was secured at the elevation of 8,000 feet which was the level over which we passed the camp.

A Naval Encampment

Utilizing the distinctly artistic San Diego again contributed to the war in no uncertain way when it placed its magnificent park at the disposal of the naval authorities. We glided over this district on the same level that we passed Kearny and most of the park was encompassed in the scope of the six inch focus lens of the camera.

Coloring From the Air

I never cease to marvel, when in either an airplane or in a balloon, at the marvelous colors which spread out beneath one. This was especially true in negotiating the air over the beautiful grounds of the thousand-acre park, not long since the scene of the Panama-Pacific Exposition. Owing to the vertical vision there is advantage about airplane and balloon observation totally lacking in any other view.

Someone has compared such a scene to an exquisite Persian rug spread out beneath them. Be that as it may every field, every kind of crop, the varying geological formations all stand out with startling clearness. Viewed from above, low trees, brush and other chaparral have a texture of almost inviting downiness. I have often thought that a good colorist could make his fortune if he would paint from a balloon basket or the cockpit of an airplane.

As in all art there is no gain without some loss. Although the colors stand out with great vividness the majesty of the mountains and the beauty of the canyons and the running streams is lost. In my opinion there is still but one way to enjoy nature and that is on foot or on horseback. The airplane is no improvement over the automobile for the enjoyment of scenery.

Los Angeles Landing Fields

As the ship swung to the northeast shortly after passing over Long Beach, we entered what might well be termed the zone of maximum activity in applied aeronautics; that is, the region embraced by the corporate limits of Los Angeles and its vicinity.

There are some thirteen landing fields in and about Los Angeles; a few are laid out and marked in accordance with regulations, others are merely convenient places wherein to safely land in cases of emergencies.

Agriculture vs. Aeronautics

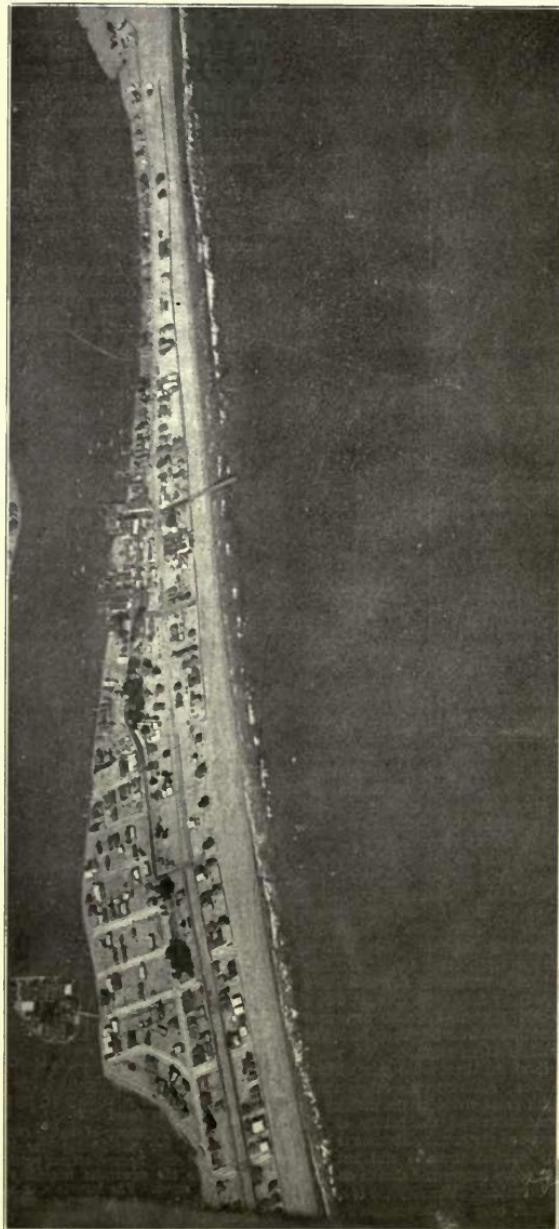
One of the great difficulties in securing landing fields is the utilization of such large parcels of land for agricultural uses. For example, as we flew over the recently acquired property of the Goodyear Company at Ascot Park our glasses showed all of the proposed aero field to be set out in cabbages!

Level stretches of property within ready access of transportation lines and good roads may not be procurable without paying from \$500 to \$2,000 per acre. When we consider how commodious a field is now necessary to safely land a large airplane, it is then realized that



LOOKING UP LAGUNA CANYON
Elev. 4300 Ft. 4:40 p. m., July 17, 1919
Camera faced NE

The village of Laguna is above the series of cliffs which are considerably over 100 feet above the sea. Laguna canyon reaches far back into the mountains towards the San Joaquin ranch. The mountain in the distance is Santiago Peak, 5000 feet high, or about 700 feet above the level of the camera.



NEWPORT BEACH FROM AN ELEVATION OF 4,900 FEET
4:45 p. m. July 17, 1919 Camera faced NE and Down

This nearly vertical view of Newport Beach and a portion of Balboa and Balboa Island shows the clustered cottages, the hotels, bathhouses and pavilions of this popular seaside resort. The wharf leads out into the sea and may be observed in the middle of the photograph. At the end of the wharf the street terminates in the Balboa landing stage for the Balboa Island and the Balboa Piersides. Beyond this narrow strip of sand is the sunlocked and almost shallow Newport harbor. This harbor is now being dredged and active work is being undertaken to dredge and otherwise improve it. Newport has the only available harbor between San Diego bay on the south and San Pedro harbor on the north.

This photograph is on too large a scale to include the recently established meteorological station which the Orange County Harbor Commission in cooperation with the United States Weather Bureau established on the heights overlooking the ocean entrance. This meteorological station displays information, cautionary and storm flag signals by day and electric light signals by night. There is also maintained by the cooperative observer (acting for the Orange County Harbor Commission and the Weather Bureau), automatic and continuous wind velocity and direction data as well as temperature, relative humidity, rainfall, fog and other weather data. This important station from which aviators flying between San Diego and Los Angeles may get dependable data on which to plot their course has an observer constantly on duty and this station is equipped with long distance telephone.



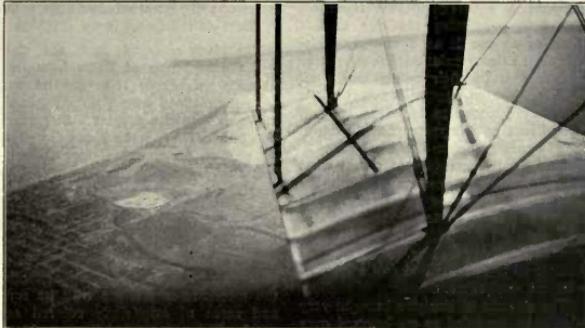
SIGNAL HILL NEAR LONG BEACH
Elev. 6150 ft. 5:05 p. m. July 17, 1919
Camera faced SW

Signal Hill and surrounding truck gardens are in the center of the photograph; Long Beach is in the background.

there are some serious difficulties in store for those whose duty it is to find and lay out these fields.

The Municipal Landing Field of Los Angeles

Seen from the air, the "Field of the Flying Foot" as the Ascot Park will probably be named, assumes satisfactory



LONG BEACH AND SAN PEDRO BAY (ELEV. 6000 FT.)
5:00 p. m. July 17, 1919 Camera faced NW

The city of Long Beach is in the foreground, San Pedro bay is to the left and Point Fermin is in the distance. The Palos Verdes hills are in the background.

proportions. It is oriented properly, in relation to the prevailing winds, and it i. e., the field is rightly located in rela- is of proper size. The Goodyear people



SOUTHWESTERN PORTION OF LOS ANGELES (ELEV. 1300)
6:05 p. m. July 17, 1919 Camera faced NE
The San Gabriel range is in the background; Wilshire boulevard is in the foreground.



SOUTHEASTERN LOS ANGELES AND DRAINAGE AREA OF THE LOS ANGELES RIVER (ELEV. 5300 FT.)
5:15 p. m. July 17, 1919 Camera faced N
The right foreground shows the Los Angeles and Rio Hondo. The rectangular marks are the city streets of Los Angeles.

propose a generous policy regarding this field, permitting the city of Los Angeles to use it as a municipal air-drome. Private aviation interests may also use it in their public work; all uses subject to regulations which the company propose to make as easy of compliance as circumstances will allow.

Landing Fields Are Harbors

It is hardly necessary to repeat what may be termed an aeronautic axiom that landing fields are as necessary to aircraft as harbors are to ships. The value of a landing field, like a harbor, is in proportion to its size, proximity to centers of population and to its meteorological environment.

The element of size was brought very clearly to my mind as we hovered over the southern outskirts of the city. To the northwest was the Ince Field, at Venice; nearly to the west the Culver Field; and to the north, the Syd Chaplin and the De Mille Fields. Selecting the latter as our destination we leveled off and made a good landing.

The Three Thousand-Foot Level

A glance at the reproduction of the barograph record on this page will show that after spiraling upwards, the pilot levelled out on the 3,000 foot level which he kept over the city of Los Angeles and intervening cities for the ensuing fifty miles. This level was held until just before we rose to 4,000 feet in order to make the glide to the home field.

Uniform Flying Ordinance

Fliers and non-fliers agree that indiscriminate flying over cities should be vigorously discouraged. It is hopeful sign that legislation is now being pushed in southern California so that uniform flying laws may be in effect throughout the various cities and counties of this district. The southern California City Attorneys' association has this matter in hand and expect to offer for ratification a series of sensible ordinances governing the manoeuvring of aircraft over municipalities.

Over Point Loma

As the ship headed straight out over Point Loma and Ballast Point could be dimly seen beneath us through the velo cloud, I harked back to my first trip in an airplane* four years before from the same field, and also in an army plane. The sensations then were of extreme novelty, and it must be confessed, that it was with some trepidation that that early journey was begun. And, now what a difference! Then flying was in its infancy; the late Major Oscar Brindley was my pilot and in 1915 we used the latest machine, No. 50. Today's plane was No. 41913, and by

* Aviator and the Weather Bureau.
Floyd A. Carpenter, San Diego, 1915.

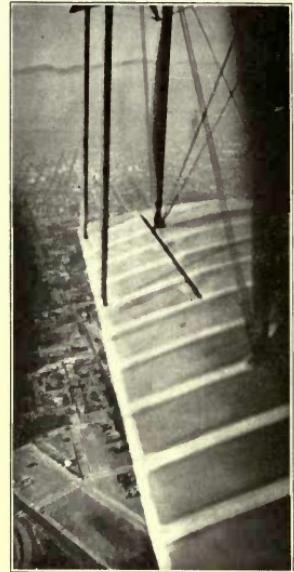
no means the latest number now in use.

Skirting the Coast in an Airplane

The plane emerged from the cloud and the backbone of Point Loma was beneath us. From this point on until we swung inland near Point Firmin the trip was that of a seaplane. For nearly one hundred miles the plane thundered its way on an even keel four thousand feet above the shimmering sea. Whenever the ship swung towards the shore even ever so slightly the differing paths could be readily determined by the contrasting shades. As color values were entrancing when flying over the fields, so also was the sight when skimming the meadows of the sea with its acres and acres of exquisitely colored seaweed. This was especially in evidence as we winged our way over La Jolla with its turquoise bay and paralleled opalescent cliffs of Del Mar. The hum of the motor and the singing of the struts and stays in the hurrying air, together with the even temperature so near the ocean, produced a drowsiness and only the imperative duty of making five-minute stops kept me awake.

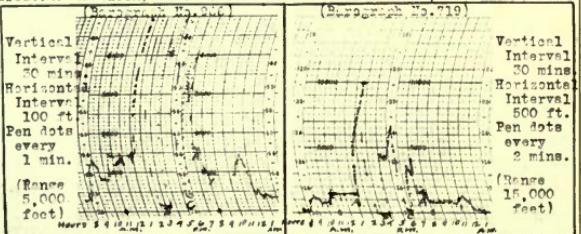
A Physiological Self-Examination

Seated comfortably and calmly in the protected cockpit I took advantage of the opportunity for a careful self-examination as to the effect of flying on the human system so far as I was personally concerned. I reviewed the pulse tests which I had made at differing elevations; at 10,000 feet or at 2,000 there was not the difference of half a dozen beats. The bodily temperature remained the same at different altitudes. In the



CENTRAL PORTION OF LOS ANGELES
Elev. 2000 ft. 6:07 p. m. July 17, 1919
Camera faced N.

AUTOGRAPHED BY ROBERT C. GUNNIS
March Field to Rockwell Field and Return via Los Angeles, July 17, 1919
Airplane #4913 (De "A" Hispano Suiza)
Lieut. W. F. Queen, U.S.A. (L) Pilot; Dr. Fred L. Gruenert, Meteorologist.



References:

A March Field 1/2 miles S of Riverside
B Rockfield Field 2 miles SE of San Diego
C De Mille Field 7 miles W of Los Angeles
(Tracings at beginning and end show trolley trip from Los Angeles)
 Total mileage 280; time, 239 minutes; maximum elevation, 10,000 ft. at
 2:25 p.m.

PHOTOGRAPHIC COPY OF BAROGRAPH RECORD

The meteorologist carried two aviators' barographs during the journey and the sheets photographed above, show the automatic registering of each minute of the journeys. The notes are self-explanatory.

sudden drop from 10,000 feet to sea-level at Rockwell Field I noticed pains in the ears which lasted several minutes after landing. There was not at any time the least sensation of dizziness although being readily subject to seasickness or carsickness. I had long wanted to try out whether or not I could hear myself shout in a plane. Removing the helmet I yelled at the top of my voice but such was the drone of the motor and the hurricane blast of air that even the head-noise could not be distinguished.

Wind Effect of Debouching Canyons

Most pilots state that with a fast plane there is no appreciable effect on traveling past the mouth of canyons debouching into the sea. In order to prove or disprove this the following observations were made. As is well known, the sea-coast from Point Loma to Point Firmin is furrowed by deep canyons emptying into the ocean. The speed of the plane was too rapid to permit a view of approaching canyons, so for several minutes at a time I closed my eyes in order that sight might not confuse a pre-conceived notion, only opening them when the ship lurched. Five observations thus made of slight sideslips were directly traceable to the passing of canyon mouths.

Photographic Equipment

Perhaps a word as to the photographic equipment used in this journey through "the landscape of the sky."

It has long been my feeling that it was the man behind the gun rather than the gun that brought down the game,—but that goes without saying. At any rate I think that a man should take with him a camera which he is perfectly

familiar with. My own practice is to use a common kodak fitted with a fine astigmat lens and a reliable shutter. A universal direct view finder is essential as are also two kinds of ray-filters. On my first journey, many years ago, I was foolish enough to take a foreground filter! Little did I then realize that there is no foreground in the air! Also, there is no need for focusing. It is necessary to set the scale at 100 feet and the shutter and diaphragm at appropriate values and use the camera as man would a machine-gun.

One precaution is necessary in the air: the film must be rolled up with great deliberation, for quick turning of the spool will cause static in the dry air of these elevations with consequent hair lines and blotches on the film. The film must be handled with extreme care both before and after taking the picture.

Instruments Used on the Trip

Before bringing this narrative to a close it might be worth while to mention some of the instruments used independently of the regulation altimeter, compass, etc. I refer to the photographic and meteorological apparatus.

Barograph Record of Journey

Two barographs were taken on this journey, one recording on an open scale up to five thousand feet and the other over a more constricted profile up to fifteen thousand feet. As will be seen by the reproduction on this page both instruments gave highly comparable and therefore satisfactory results. Naturally the needle passed off the limits of the sheet on the first instrument, but all of the journey was recorded on the

second barograph with five thousand feet to spare.

I found these barographs of very great utility in all journeys whether on foot, horseback, automobile, railroad, balloon or airplane. In fact on all means of travel, save by steamboat, these barographs give an automatic record of every moment of the journey.

The Homeward Flight

After traversing more than half a hundred miles of air fragrant with orange blossoms we flew over Riverside and dropped into the home field. A few minutes after landing I was on a motorcycle and shortly afterwards passed through the hospitable arches of the Mission Inn. Here was where I had lunched only a few hours before and now the cool and quiet interior and warm and friendly greeting of the Master of the Inn added the finishing touches of anticipation of the waiting dinner.

And thus this air trip was ended ninety miles over the mountains, one hundred and thirty along the sea coast and sixty over the orange and lemon groves. Into these four hours of flying were crowded studies of air currents; photographing of clouds at close range; testing out of some intutional theories and the intimate observation of land, sea and sky. So much was thus made possible in so little time that to my mind this journey brings out with startling distinctness the one great outstanding fact in flying—the expansion of time. In obeying the scriptural injunction "shall mount up with wings as eagles" the airman takes hold upon divinity for can he not also say with scripture "One day is with the Lord as a thousand years, and a thousand years as one day?"

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